

Please cancel claim 26.

Please amend claim 27 as follows:

27. (Amended) A scanning apparatus, comprising:

a primary mirror that moves through a predetermined scan path at a selected scan rate having a scanning period; and

a resonant reflector aligned to the scanning mirror and being of a type that moves resonantly through a movement path at a resonant frequency, wherein the scan period is an integral multiple of the resonant frequency wherein the resonant reflector is a MEMS membrane and wherein the movement path includes deformation of the membrane.

Please amend claim 28 as follows:

28. (Amended) A scanning apparatus, comprising:

a primary mirror that moves through a predetermined scan path at a selected scan rate having a scanning period; and

a resonant reflector aligned to the scanning mirror and being of a type that moves resonantly through a movement path at a resonant frequency, wherein the scan period is an integral multiple of the resonant frequency wherein the resonant reflector is a mirror mounted for rotation about a pivot axis orthogonal to the primary mirror and wherein the movement path includes rotation of the resonant reflector about the pivot axis.

REMARKS

This amendment responds to the Office action mailed May 21, 2001. Claims 3-25 and 27-29 remain after this amendment. Claims 2 and 26 are canceled

hereby. Claims 6 and 9 have been amended to incorporate the limitations of canceled claim 2 and claims 3 and 8 have been amended to depend from claims 2 and 6 respectively. Claims 27 and 28 have been amended to incorporate the limitations of canceled claim 26. Claims 8 and 9 have been amended to correct minor typographical errors and claim 14 has been amended to depend from claim 13 and to more distinctly claim the appropriate subject matter.

With respect to the remaining claims, the Examiner has rejected claims 3-10, 16 and 25, 27-29 as being anticipated by Montagu. Additionally, the Examiner has rejected claims 6, 7, 17-20 and 21-25 under 35 U.S.C. §103 as being unpatentable over Montagu in view of Dhuler. The Examiner has also rejected claims 1 and 15 as being anticipated by Wood and claims 12-14 as being unpatentable over the combination of Wood and Dhuler.

Applicants submit that none of the cited references, alone, or in combination, teach the subject matter of the currently presented claims. As an example, claim 6 recites “the controllable optical element includes a deformable membrane responsive to the control signal to deform to produce the corresponding correction.” Applicants submit that none of the cited references teaches or suggests this aspect of the invention.

The Montagu reference teaches an additional scanning element that provides an additional “x-axis scanner” that combines with a primary scanner to produce a “substantially linear – motion of the target spot.” Col. 4, lines 52-54. There is no teaching of any deformable structure, no scanning system incorporating a deformable structure, and no deformation that produces a correction in a scanning system.

Applicants disagree with the Examiner’s reliance upon Dhuler as teaching this aspect of the invention as a MEMS device. First, Applicants note that the Dhuler reference relates to a rotating plate, not a “deformable membrane.” Dhuler essentially teaches a rotating MEMS mirror. Dhuler’s figures and description relate to a simple

MEMS mirror structure and does not teach the recited aspects and does not add a deformable membrane to the teaching of Montagu.

This differentiating aspect is similarly highlighted by claim 9's recitation that "the predicted deviation is a phase front distortion" and "the corresponding distortion correction" from the optical element is "an offsetting phase front distortion." Neither Montagu nor Dhuler relate to a phase front distortion or any approach to correction of a phase front distortion in a scanning system. Moreover, neither reference teaches or suggests the deformable membrane recited in claim 10.

Similarly, claim 16 recites an "optical element ... operative to pre-distort the beam of light in a periodic manner corresponding to the orientation of the scanning mirror in the predetermined angular range." Applicants have identified no teaching in the relied upon references of an active optical element that predistorts a beam of light in a periodic pattern. Consequently, Applicants submit that the cited references do not teach or suggest the recited approach to a scanning beam system of claim 16 and its dependent claims.

Claims 17 and 18 add to claim 16 that the element is a MEMS device and that it is a deformable membrane. As discussed above, there is no teaching or suggestion of such a structure in the cited references and these claims are even further distinguished.

Claim 27 is similarly distinguishable in its recitation of that the "resonant reflector is a MEMS membrane" and in its recitation that "the movement path includes deformation of the membrane." As described previously, the cited references fail to teach or suggest these aspects.

Claim 28 recites the limitations of former claim 26 as well as the "mirror mounted for rotation about a pivot axis orthogonal to the primary mirror." As noted above, the Montagu reference tries to linearize the x scan by adding a second x scanner. The recitation of claim 28 includes that the correction relates to a scan that is resonant

and orthogonal to the first scan. There is no teaching or suggestion in Montagu or any other cited reference of a resonant correction about an axis different from the primary axis to provide a corrected scan path.

The Examiner has rejected claims 11 and 15 as being anticipated by Wood. Applicants submit that the Wood reference does not anticipate or render obvious the claim invention. For example, claim 11 recites “a scanner positioned in a path of a beam, the scanner sweeping through a plurality of scanning positions during a scan period.” The Wood reference does not describe or suggest a scanning system. In fact, because the Wood system uses spatial light filter to generate a Fourier correction, it appears that the Wood system assumes a fixed beam location.

Additionally, claim 15 recites a “wavefront corrector having a response time sufficiently fast to provide the respective offsetting wavefront distortion for each of the respective scanning positions during the scanning period.” There is no discussion in Wood of any response time of a wavefront corrector or of a wavefront corrector that provides an offsetting wavefront distortion “for each of the respective scanning positions during the scanning period.”

With respect to claim 15, all of the distinctions described previously with respect to claim 11 also apply. Additionally, claim 15 recites an electrical detector that “produces an electrical signal indicative of an intensity of the received corrected beam.” Applicants submit that the citation by the Examiner does not apply to this aspect of claim 15. Applicants further note that the electronic controller to which the Examiner refers appears to be a calculated spatial light function that operates as a filter in the Fourier domain (see, e.g., Col.3 lines 13-25). Accordingly, claim 15 is even further distinguishable from the Wood reference.

The Examiner has rejected claims 12-14 as being obvious over Wood in view of Dhuler. Applicants note that the subject matter of claim 11, from which these claims depend, is distinguished over Wood, as previously described. The teaching of

Dhuler does not add any of these aspects of claim 11. Moreover, as discussed previously, the Dhuler reference does not teach "a deformable membrane" as recited in claim 12 or the MEMS deformable membrane of claim 13. Claim 14, in addition to the elements of claim 11, adds "a correction scanner aligned to produce a corrective shift orthogonal" to the original scan pattern. None of Wood, Dhuler, or Montagu teaches this aspect (Applicants note that the second scanner of Montagu is not "aligned to produce a corrective shift orthogonal" to the original scan pattern).

Applicants submit that the currently presented claims are distinguishable over the cited references and are thus allowable. The Examiner is invited to contact Mr. Casey T. Tegreene at (425) 415-6621 with any issues that may advance prosecution of the application on the merits.

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Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Versions with markings to show changes made."

Respectfully submitted,

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Enclosures:

Postcard
Check
Transmittal and Fee Calculation Cover Sheet (+ copy)
Petition for Extension of Time (+ 2 copies)

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the claims:

Claim 2 has been canceled.

~~2. An optical scanning system, comprising:~~

~~_____ an input port positioned to accept an input light beam;~~
~~_____ at least one deflector aligned to receive the input light beam from the input port and oriented to redirect the received light beam through a selected scan pattern, the deflector being of a type that produces a predicted deviation of the redirected light beam from a desired light beam at respective locations in the selected scan pattern;~~
~~_____ an electrical control circuit operative to produce a control signal corresponding to the selected scan pattern; and~~
~~_____ a controllable optical element positioned to receive either of the input light beam or the redirected light beam and having an input terminal for receiving the control signal, the optical element being responsive to the control signal to produce a corresponding correction that offsets the predicted deviation.~~

Claim 3 has been amended as follows:

3. (Amended) The optical scanning system of claim 6 2 wherein the at least one deflector includes a mirror mounted for rotation about a pivot axis.

Claim 6 has been amended as follows:

6. (Amended) An optical scanning system, comprising:

an input port positioned to accept an input light beam;

at least one deflector aligned to receive the input light beam from the input port and oriented to redirect the received light beam through a selected scan pattern, the deflector being of a type that produces a predicted deviation of the redirected light beam from a desired light beam at respective locations in the selected scan pattern;

an electrical control circuit operative to produce a control signal corresponding to the selected scan pattern; and

a controllable optical element positioned to receive either of the input light beam or the redirected light beam and having an input terminal for receiving the control signal, the optical element being responsive to the control signal to produce a corresponding correction that offsets the predicted deviation. ~~The optical scanning system of claim 2~~ wherein the controllable optical element includes a deformable membrane responsive to the control signal to deform to produce the corresponding correction.

Claim has has been amended as follows:

8. (Amended) The optical scanning system of claim 6 2-wherein ~~the~~ at least one deflector includes a positioned detector that provides an electrical signal indicative of an angle at which the deflector redirects the light beam, and wherein the electrical control circuit is coupled to receive the electrical signal and is responsive to the electrical signal to produce the control signal.

Claim 9 has been amended as follows:

9. (Amended) An optical scanning system, comprising:

an input port positioned to accept an input light beam;

at least one deflector aligned to receive the input light beam from the input port and oriented to redirect the received light beam through a selected scan pattern, the deflector being of a type that produces a predicted deviation of the redirected light beam from a desired light beam at respective locations in the selected scan pattern;

an electrical control circuit operative to produce a control signal corresponding to the selected scan pattern; and

a controllable optical element positioned to receive either of the input light beam or the redirected light beam and having an input terminal for receiving the control signal, the optical element being responsive to the control signal to produce a corresponding correction that offsets the predicted deviation ~~The optical scanning system of claim 2 wherein the predicted deviation distortion~~ is a phase front distortion and wherein the corresponding distortion correction is an offsetting phase front distortion.

Claim 14 has been amended as follows:

14. (Amended) The imaging apparatus of claim ~~12~~13 wherein the plurality of scan positions define a scan pattern, further including ~~wherein the wavefront corrector includes~~ a correction scanner aligned to produce a corrective shift orthogonal to ~~in the~~ scan pattern ~~beam path~~.

Claim 26 has been canceled.

~~26. A scanning apparatus, comprising:~~

~~_____ a primary mirror that moves through a predetermined scan path at a selected scan rate having a scanning period; and~~

~~_____ a resonant reflector aligned to the scanning mirror and being of a type that moves resonantly through a movement path at a resonant frequency, wherein the scan period is an integral multiple of the resonant frequency.~~

Claim 27 has been amended as follows:

27. (Amended) A scanning apparatus, comprising:

a primary mirror that moves through a predetermined scan path at a selected scan rate having a scanning period; and

a resonant reflector aligned to the scanning mirror and being of a type that moves resonantly through a movement path at a resonant frequency, wherein the scan period is an integral multiple of the resonant frequency ~~The apparatus of claim 26~~ wherein the resonant reflector is a MEMS membrane and wherein the movement path includes deformation of the membrane.

Claim 28 has been amended as follows:

28. (Amended) A scanning apparatus, comprising:

a primary mirror that moves through a predetermined scan path at a selected scan rate having a scanning period; and

a resonant reflector aligned to the scanning mirror and being of a type that moves resonantly through a movement path at a resonant frequency, wherein the scan

period is an integral multiple of the resonant frequency ~~The apparatus of claim 26~~
wherein the resonant reflector is a mirror mounted for rotation about a pivot axis
orthogonal to the primary mirror and wherein the movement path includes rotation of the
resonant reflector about the pivot axis.